

REMARKS

Applicants request favorable reconsideration and allowance of the subject application in view of the preceding amendments and the following remarks.

Claims 1 through 37 are presented for consideration. Claims 1, 12, 19, 22, 23, 26 and 32 are independent. Claims 1, 3, 5, 6, 12, 13, 19, 22 and 23 have been amended to clarify features of the subject invention, while claims 26 through 37 have been added to recite additional features of the subject invention. Support for these changes and claims can be found in the original application, as filed. Therefore, no new matter has been added.

Applicants request favorable reconsideration and withdrawal of the rejections set forth in the above-noted Office Action.

Figs. 13 and 14 objected to under M.P.E.P. § 608.02(g) as illustrating what is old have been required to be labeled as "PRIOR ART". Fig. 15 is also disclosed as prior art at least at line 26 of page 4 in the specification. Accordingly, it is proposed to amend each of Figs. 13, 14 and 15 by adding a label "PRIOR ART". The proposed changes are shown indicated in red in the enclosed drawing sheets. Approval of the changes is respectfully requested.

Fig. 2 has been objected to under 37 C.F.R. § 1.84(p)(5) as not including element 29 referred to in the specification as the Y mirror. The Y mirror element 29 is shown in Fig. 1 and the specification has been amended at page 14 make reference to the location of the Y mirror element 29 in Fig. 1.

The specification and the abstract have been carefully reviewed and amended as to matters of form. The specification has been amended to correct typographical and inadvertent errors and to improve idiomatic English.

Claims 1-4, 6, 8, 11, 12 and 14-17 have been rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,285,457 (Ukaji). Claims 5, 9, 10, 13, 18, 24 and 25 have been rejected under 35 U.S.C. § 103 as being unpatentable over Ukaji. With regard to the claims as currently amended, these rejections are respectfully traversed.

Independent Claim 1 as currently amended is directed to exposure apparatus in which a projection optical system projects a pattern formed on a master onto a substrate. A lens barrel support supports the projection optical system. A stage capable of moving with respect to the projection optical system while holding at least one of the substrate and the master has a Z measuring mirror arranged thereon. The Z measuring mirror has a reflecting surface substantially parallel to the XY plane. An interferometer system has an interferometer that measures Z position and displacement of the stage with respect to the lens barrel support by using the reflecting surface of the Z measuring mirror.

Independent Claim 12 as currently amended is directed to exposure apparatus. In the exposure apparatus, a Y stage is movable in the Y direction and an X stage is movable in the X direction with respect to the Y stage. A Z mirror mounted on the X stage or the Y stage has a reflecting surface parallel to the XY plane. A mirror or prism guides to the X mirror a beam emitted to the Z direction by the Y stage and an interferometer detects the Z position of the X stage or the Y stage by using the beam reflected by the reflecting surface of the Z mirror.

In Applicants' view, Ukaji discloses an exposure apparatus that includes a projection optical system, a barrel supporting member for supporting the projection optical system and a stage being movable relative to the projection optical system. A base supports the stage and a base measuring system measures at least one of a position and a displacement of the base with respect to the barrel supporting member. A stage measuring system measures at least one of a position and a displacement of the stage with respect to the barrel supporting member.

According to the invention defined in Claim 1, a Z measuring mirror arranged on a movable stage has a reflecting surface substantially parallel to an XY plane and an interferometer measures the Z position and displacement of the stage using the reflecting surface of the Z measuring mirror. In Claim 12, a Z mirror mounted on an X or Y stage has a reflecting surface parallel to the XY plane and an interferometer detects the Z position of the X or Y stage using a beam reflected from the reflecting surface of the Z mirror. Advantageously, the use of a reflecting surface of a Z mirror on the stage that is parallel to the XY plane allows highly precise positioning without the need for extreme accuracy in processing the mirror.

Ukaji may teach exposure apparatus in which position information of the Z direction of a stage is measured by an interferometer. As disclosed at lines 30 through 39 of column 5 of Ukaji with respect to Fig. 2, the reflection surface 31b is provided by an inclined reflection surface and it is an optical component being disposed obliquely with an angle of 45 deg. or more in the wY direction with respect to the X-Y plane. In Ukaji, it is required that a mirror having an inclined reflection surface be disposed on a stage. Any error in the accuracy in processing the mirrors 31a and 31b of Ukaji adversely affects the positioning accuracy obtained. In contrast to Ukaji's

inclined reflection surface of an XY stage, it is a feature of Claims 1 and 12 that a Z measuring mirror arranged or mounted on a stage has a reflecting surface substantially parallel to the stage and another feature that an interferometer measures or detects the Z position of the stage using the reflecting surface of the Z measuring mirror. As a result, dependency on the accuracy of processing a slanting surface as in Ukaji is avoided. Accordingly, it is not seen that Ukaji's inclined reflecting surface structure on a stage could possibly teach or suggest the features of Claims 1 and 12. It is therefore believed that Claims 1 and 12 as currently amended are completely distinguished from Ukaji and are allowable.

Claims 19-23 have been rejected under 35 U.S.C. § 103 as being unpatentable over Ukaji. With regard to the claims as currently amended, this rejection is respectfully traversed.

Independent Claim 19 as currently amended is directed to a semiconductor manufacturing method in which plural semiconductor manufacturing apparatuses including an exposure apparatus are installed in a factory. A semiconductor device is manufactured by using the plural semiconductor manufacturing apparatuses. In the exposure apparatus, a projection optical system projects a pattern formed on a master onto a substrate. A lens barrel support supports the projection optical system. A stage capable of moving with respect to the projection optical system while holding at least one of the substrate and the master has a Z measuring mirror arranged thereon. The Z measuring mirror has a reflecting surface substantially parallel to the XY plane. An interferometer measures Z position and displacement of the stage with respect to the lens barrel support by using the reflecting surface of the Z measuring mirror.

Independent Claim 22 as currently amended is directed to a semiconductor manufacturing factory in which plural semiconductor manufacturing apparatuses include an exposure apparatus. A local area network connects the plural semiconductor manufacturing apparatuses and a gateway connects the local area network to an external network outside the semiconductor factory. Information about at least one of the plural semiconductor manufacturing apparatuses can be communicated. In the exposure apparatus, a projection optical system projects a pattern formed on a master onto a substrate. A lens barrel support supports the projection optical system. A stage capable of moving with respect to the projection optical system while holding at least one of the substrate and the master has a Z measuring mirror arranged thereon. The Z measuring mirror has a reflecting surface substantially parallel to the XY plane. An interferometer measures Z position and displacement of the stage with respect to the lens barrel support by using the reflecting surface of the Z measuring mirror.

Independent Claim 23 as currently amended is directed to a maintenance method for an exposure apparatus installed in a semiconductor manufacturing factory in which a database for accumulating information about maintenance of the exposure apparatus is prepared on an external network outside the factory where the exposure apparatus is installed. The exposure apparatus is connected to a local area network in the factory and the exposure apparatus is maintained on the basis of information accumulated in the database by using the external network and the local area network. In the exposure apparatus, a projection optical system projects a pattern formed on a master onto a substrate. A lens barrel support supports the projection optical system. A stage capable of moving with respect to the projection optical system while holding at least one of the

substrate and the master has a Z measuring mirror arranged thereon. The Z measuring mirror has a reflecting surface substantially parallel to the XY plane. An interferometer measures Z position and displacement of the stage with respect to the lens barrel support by using the reflecting surface of the Z measuring mirror.

It is one feature of Claims 19, 22 and 23 that a Z measuring mirror arranged in a stage has a reflecting surface substantially parallel to the XY plane and another feature that an interferometer measures the Z position and the displacement of the stage with respect to a lens barrel support using the reflecting surface of the Z measuring mirror. As discussed with respect to Claims 1 and 12, Ukaji may disclose exposure apparatus in which Z direction position information is measured by an interferometer but uses a reflection arrangement that is restricted to a mirror having one reflection surface 31a disposed perpendicularly to an X plane and an inclined reflection surface 31b extending therefrom to reflect light for Z position detection. Accordingly, it is not seen that Ukaji's inclined reflection surface for Z position detection in any manner suggests the feature of a Z measuring mirror with a reflection surface parallel to the XY plane of a stage for use in measuring the Z position of a stage by an interferometer as in Claims 19, 22 and 23. It is therefore believed that Claims 19, 22 and 23 as currently amended are completely distinguished from Ukaji and are allowable.

Newly added independent Claim 26 is directed to exposure apparatus in which a barrel support supports a projection lens. A stage capable of moving along an XY plane has a reflecting surface substantially parallel to the XY plane. An interferometer used to search for information

indicating the position of a Z direction of the stage to the barrel support uses light reflected in the reflecting surface.

Newly added Claim 32 is directed to exposure apparatus which has a barrel support that supports a projection lens, a Y stage capable of moving in the Y direction and an X stage capable of moving in the X direction to the Y stage while supporting a substrate on which a pattern is projected through the projection lens. A Z interferometer is used to search for information indicating the position of a Z direction of the X stage to the barrel support using light reflected in the reflecting surface of the Z mirror.

As discussed with respect to Claims 19, 22 and 23, Ukaji discloses exposure apparatus which is restricted to a reflection arrangement of a mirror having an inclined reflection surface 31b to reflect light for Z position detection. In contrast to the inclined reflecting surface of Ukaji, it is a feature of Claims 26 and 32 that a stage capable of moving along an XY plane has a reflecting surface substantially parallel to the XY plane or a Z mirror with a substantially parallel reflecting surface in the XY plane that moves with an X stage and another feature that an interferometer searches for information indicating the Z position of the stage to a barrel support using the light reflected in the reflecting surface. It is not seen that Ukaji's inclined reflecting surface for detecting the Z position of a stage in any manner teaches or suggests the parallel reflecting surface on a stage for Z position indicating of Claims 26 and 32. Accordingly, it is believed that newly added Claims 26 and 32 are completely distinguished from Ukaji and allowable.

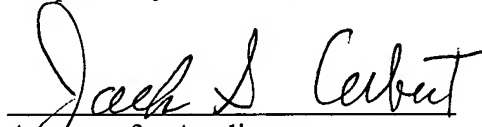
For the foregoing reasons, Applicant submits that the present invention, as recited in independent claims 1, 12, 19, 22, 23, 26 and 32, is patentably defined over the cited art.

Dependent claims 2-11, 13-18, 20, 21, 24, 25, 27-31 and 33-37 also should be deemed allowable, in their own right, for defining other patentable features of the present invention in addition to those recited in their respective independent claims. Further individual consideration of these dependent claims is requested.

Applicants further submit that the instant application is in condition for allowance. Favorable reconsideration, withdrawal of the rejections set forth in the above-noted Office Action and an early Notice of Allowance are requested.

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Respectfully submitted,


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